CS422 Assignment 1

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Introduction

We are using instruction-level instrumentation and have conducted our experiments on the machine image1.cse.iitk.ac.in. Initially, our implementation introduced a large number of calls, leading to significant overhead. Some programs took several hours to run, with one taking up to 40 hours. To optimize performance, we reduced the number of calls and combined some analysis functions, significantly improving execution times. The maximum time taken for any program is now approximately 8 hours, with most of them completing within 2 hours.

Analysis of 400.perlbench diffmail.pl

PART A

- Number of loads: 355810344 (22.77%)
- Number of stores: 206686870 (13.22%)
- Number of nops: 990625 (0.06%)
- Number of direct calls: 12955321 (0.83%)
- Number of indirect calls: 2787758 (0.18%)
- Number of returns: 15743079 (1.01%)
- Number of unconditional branches: 30467792 (1.95%)
- Number of conditional branches: 130116986 (8.33%)
- Number of logical operations: 100571792 (6.44%)
- Number of rotate/shift operations: 4240599 (0.27%)
- Number of flag operations: 875581 (0.06%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 976118 (0.06%)
- Number of other instructions: 700111265 (44.81%)

PART B

- CPI: 25.8425

PART C

- Number of 32-byte regions for data: 31204
- Number of 32-byte regions for instructions: 2808

PART D

D1 Distribution of instruction length (All Ins)

- Number of Instruction of 0 bytes: 0
- Number of Instruction of 1 byte: 117800933
- Number of Instruction of 2 bytes: 257073821
- Number of Instruction of 3 bytes: 275141193
- Number of Instruction of 4 bytes: 53044156
- Number of Instruction of 5 bytes: 78588151
- Number of Instruction of 6 bytes: 184399411
- Number of Instruction of 7 bytes: 33952296
- Number of Instruction of 8 bytes: 28
- Number of Instruction of 9 bytes: 0
- Number of Instruction of 10 bytes: 12

D2 Distribution of the number of operands in an instruction (All Ins)

- Number of Instruction of 0 operands: 990625
- Number of Instruction of 1 operand: 1075706
- Number of Instruction of 2 operands: 520062985
- Number of Instruction of 3 operands: 354977322
- Number of Instruction of 4 operands: 103929443
- Number of Instruction of 5 operands: 15744802
- Number of Instruction of 6 operands: 3219118

D3 Distribution of the number of register read operands in an instruction (All Ins)

- Number of Instruction of 0 register read operands: 10347852
- Number of Instruction of 1 register read operand: 259411698
- Number of Instruction of 2 register read operands: 538376142
- Number of Instruction of 3 register read operands: 179207519
- Number of Instruction of 4 register read operands: 6902676
- Number of Instruction of 5 register read operands: 2534996
- Number of Instruction of 6 register read operands: 3219118

D4 Distribution of the number of register write operands in an instruction (All Ins)

- Number of Instruction of 0 register write operands: 136319631
- Number of Instruction of 1 register write operand: 684688257
- Number of Instruction of 2 register write operands: 175769128
- Number of Instruction of 3 register write operands: 2372831
- Number of Instruction of 4 register write operands: 850154

D5 Distribution of the number of memory operands in an instruction (Predicated Ins)

- Number of Instruction of 0 memory operands: 453322539
- Number of Instruction of 1 memory operand: 531094445
- Number of Instruction of 2 memory operands: 15419932

D6 Distribution of the number of memory read operands in an instruction (Predicated Ins)

- Number of Instruction of 0 memory read operands: 191629025
- Number of Instruction of 1 memory read operand: 354035221
- Number of Instruction of 2 memory read operands: 850131

D7 Distribution of the number of memory write operands in an instruction (Predicated Ins)

- Number of Instruction of 0 memory write operands: 340315551
- Number of Instruction of 1 memory write operand: 206198826

D8 Maximum and average number of memory bytes touched by any memory instruction (Predicated Ins)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 3.74019

D9 Maximum and minimum values of the immediate field in an instruction.

- Maximum value of the immediate field: 2147483647
- Minimum value of the immediate field: -2147483648

D10 Maximum and minimum values of the displacement field in a memory instruction (Predicated Ins)

- Maximum value of the displacement field: 135918104
- Minimum value of the displacement field: -1408

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- Time elapsed: 119.88 minutes

Analysis of 401.bzip2 input.source

PART A

- Number of loads: 452706117
- Number of stores: 231174092
- Number of nops: 36514
- Number of direct calls: 791601
- Number of indirect calls: 13
- Number of returns: 791610
- Number of unconditional branches: 21299217
- Number of conditional branches: 129923129
- Number of logical operations: 71000727
- Number of rotate/shift operations: 61831968
- Number of flag operations: 6130
- Number of vector operations: 0
- Number of conditional moves: 0
- Number of MMX/SSE operations: 0
- Number of system calls: 0
- Number of FP operations: 0
- Number of other instructions: 714315007

PART B

- CPI: 29.0233

PART C

- Number of 32-byte regions for data: 2528518
- Number of 32-byte regions for instructions: 753

PART D

D1 Distribution of Instruction Lengths

- Number of Instructions of 0 bytes: 0
- Number of Instructions of 1 byte: 38611266
- Number of Instructions of 2 bytes: 219201464
- Number of Instructions of 3 bytes: 436965614
- Number of Instructions of 4 bytes: 75326996
- Number of Instructions of 5 bytes: 22047487
- Number of Instructions of 6 bytes: 141357323
- Number of Instructions of 7 bytes: 51341609
- Number of Instructions of 8 bytes: 15085632
- Number of Instructions of 9 bytes: 0
- Number of Instructions of 10 bytes: 62610

D2 Distribution of Instruction Operands

- Number of Instructions with 0 operands: 36514
- Number of Instructions with 1 operand: 6147
- Number of Instructions with 2 operands: 597647473
- Number of Instructions with 3 operands: 382870401
- Number of Instructions with 4 operands: 2693858
- Number of Instructions with 5 operands: 14191400
- Number of Instructions with 6 operands: 2554208

D3 Distribution of Register Read Operands

- Number of Instructions with 0 register read operands: 5189068
- Number of Instructions with 1 register read operand: 183351677
- Number of Instructions with 2 register read operands: 533608148
- Number of Instructions with 3 register read operands: 215105839
- Number of Instructions with 4 register read operands: 46791262
- Number of Instructions with 5 register read operands: 13399799
- Number of Instructions with 6 register read operands: 2554208

D4 Distribution of Register Write Operands

- Number of Instructions with 0 register write operands: 132331419
- Number of Instructions with 1 register write operand: 712782442
- Number of Instructions with 2 register write operands: 152331915
- Number of Instructions with 3 register write operands: 2554225

D5 Distribution of Memory Operands

- Number of Instructions with 0 memory operands: 399852524
- Number of Instructions with 1 memory operand: 516406575
- Number of Instructions with 2 memory operands: 83736817

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 147437275
- Number of Instructions with 1 memory read operand: 452706117

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 368969300
- Number of Instructions with 1 memory write operand: 231174092

D8 Memory Byte Accesses

- Maximum number of bytes touched by an instruction: 8
- Average number of bytes touched by an instruction: 3.48541

D9 Immediate Field Values

- Maximum value of the immediate field: 1431655766
- Minimum value of the immediate field: -858993459

D10 Displacement Field Values

- Maximum value of the displacement field: 135000192
- Minimum value of the displacement field: -4848

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- Time elapsed: 133.515 minutes

Analysis of 403.gcc cp-decl.i

PART A

- Number of loads: 136,685,541 (9.13%)
- Number of stores: 360,619,677 (24.09%)
- Number of nops: 187,313 (0.01%)
- Number of direct calls: 4,519,482 (0.30%)
- Number of indirect calls: 502,811 (0.03%)
- Number of returns: 5,022,291 (0.34%)
- Number of unconditional branches: 4,747,466 (0.32%)
- Number of conditional branches: 133,315,323 (8.90%)
- Number of logical operations: 132,038,834 (8.82%)
- Number of rotate/shift operations: 2,340,918 (0.16%)
- Number of flag operations: 185,084 (0.01%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 5 (0.00%)
- Number of other instructions: 717,072,068 (47.89%)

PART B

- CPI: 23.9183

PART C

- Number of 32-byte regions for data: 1131511
- Number of 32-byte regions for instructions: 2938

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 0 bytes: 0
- Number of instructions of 1 byte: 130,009,220
- Number of instructions of 2 bytes: 593,299,322
- Number of instructions of 3 bytes: 123,629,525
- Number of instructions of 4 bytes: 116,413,558
- Number of instructions of 5 bytes: 10,753,282
- Number of instructions of 6 bytes: 15,169,491
- Number of instructions of 7 bytes: 10,667,867
- Number of instructions of 8 bytes: 57,736
- Number of instructions of 9 bytes: 0
- Number of instructions of 10 bytes: 0

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 187,313
- Number of instructions with 1 operand: 4,598,657
- Number of instructions with 2 operands: 348,425,211
- Number of instructions with 3 operands: 404,001,885
- Number of instructions with 4 operands: 33,540,970
- Number of instructions with 5 operands: 204,990,682
- Number of instructions with 6 operands: 4,255,283

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 2,118,361
- Number of instructions with 1 register read operand: 168,450,494
- Number of instructions with 2 register read operands: 471,764,786
- Number of instructions with 3 register read operands: 61,826,783
- Number of instructions with 4 register read operands: 91,114,492
- Number of instructions with 5 register read operands: 200,469,802
- Number of instructions with 6 register read operands: 4,255,283

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 126,020,180
- Number of instructions with 1 register write operand: 416,550,604
- Number of instructions with 2 register write operands: 453,037,696
- Number of instructions with 3 register write operands: 4,391,521

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 519,001,180
- Number of instructions with 1 memory operand: 464,555,615
- Number of instructions with 2 memory operands: 16,374,800

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 344244877
- Number of Instructions with 1 memory read operand: 136685538

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 120310738
- Number of Instructions with 1 memory write operand: 360619677

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 3.95976

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 1,073,741,823
- Minimum value of the immediate field: -2,147,483,587

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 138,634,432
- Minimum value of the displacement field: -1,744

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- Time elapsed: 87.96 minutes

Analysis of 429.mcf

PART A

- Number of loads: 415,213,374 (27.22%)
- Number of stores: 110,039,541 (7.21%)
- Number of nops: 1,477,640 (0.10%)
- Number of direct calls: 12,556,568 (0.82%)
- Number of indirect calls: 0 (0.00%)
- Number of returns: 12,556,567 (0.82%)
- Number of unconditional branches: 8,314,430 (0.55%)
- Number of conditional branches: 178,242,886 (11.69%)
- Number of logical operations: 75,119,464 (4.93%)

- Number of rotate/shift operations: 3,516,420 (0.23%)
- Number of flag operations: 0 (0.00%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 0 (0.00%)
- Number of other instructions: 708,216,026 (46.43%)

PART B

- CPI: 24.7616

PART C

- Number of 32-byte regions for data: 11673111
- Number of 32-byte regions for instructions: 65

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 0 bytes: 0
- Number of instructions of 1 byte: 80,626,108
- Number of instructions of 2 bytes: 485,394,960
- Number of instructions of 3 bytes: 315,526,943
- Number of instructions of 4 bytes: 50,531,707
- Number of instructions of 5 bytes: 22,076,054
- Number of instructions of 6 bytes: 5,249,475
- Number of instructions of 7 bytes: 40,594,754
- Number of instructions of 8 bytes: 0

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 1,477,640
- Number of instructions with 1 operand: 0
- Number of instructions with 2 operands: 484,783,819
- Number of instructions with 3 operands: 457,347,004
- Number of instructions with 4 operands: 43,834,970
- Number of instructions with 5 operands: 12,556,568

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 3,759,790
- Number of instructions with 1 register read operand: 148,509,146
- Number of instructions with 2 register read operands: 677,533,367
- Number of instructions with 3 register read operands: 170,197,698

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 70,905,928
- Number of instructions with 1 register write operand: 770,283,433
- Number of instructions with 2 register write operands: 158,772,128

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 487,181,825
- Number of instructions with 1 memory operand: 500,383,437
- Number of instructions with 2 memory operands: 12,434,739

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 97604802
- Number of Instructions with 1 memory read operand: 415213374

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 402778635
- Number of Instructions with 1 memory write operand: 110039541

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 4
- Average number of memory bytes touched: 4

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 1,374,389,535
- Minimum value of the immediate field: -100,000,000

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 134,957,120
- Minimum value of the displacement field: -76

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- Time elapsed: 153.97 minutes

Analysis of 436.cactusADM (Optional)

PART A

- Number of loads: 1,040,897,118 (43.88%)
- Number of stores: 331,288,185 (13.97%)
- Number of nops: 2,265 (0.00%)
- Number of direct calls: 531,583 (0.02%)
- Number of indirect calls: 193 (0.00%)
- Number of returns: 531,776 (0.02%)
- Number of unconditional branches: 535,270 (0.02%)
- Number of conditional branches: 4,305,613 (0.18%)
- Number of logical operations: 1,626,452 (0.07%)
- Number of rotate/shift operations: 1,059,308 (0.04%)
- Number of flag operations: 5 (0.00%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 851,723,634 (35.90%)
- Number of other instructions: 139,683,902 (5.89%)

PART B

- CPI: 40.9129

PART C

- Number of 32-byte regions for data: 4432170
- Number of 32-byte regions for instructions: 1224

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 1,658,075
- Number of instructions of 2 bytes: 263,441,865
- Number of instructions of 3 bytes: 78,112,021
- Number of instructions of 4 bytes: 15,678,296
- Number of instructions of 5 bytes: 1,609,525
- Number of instructions of 6 bytes: 603,728,527
- Number of instructions of 7 bytes: 35,771,692

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 2,265
- Number of instructions with 1 operand: 23
- Number of instructions with 2 operands: 83,585,107
- Number of instructions with 3 operands: 461,382,398
- Number of instructions with 4 operands: 454,498,402
- Number of instructions with 5 operands: 531,776
- Number of instructions with 6 operands: 30

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 18,274,776
- Number of instructions with 1 register read operand: 42,914,483
- Number of instructions with 2 register read operands: 532,137,785
- Number of instructions with 3 register read operands: 397,790,918
- Number of instructions with 4 register read operands: 8,881,874
- Number of instructions with 5 register read operands: 135
- Number of instructions with 6 register read operands: 30

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 149,849,562
- Number of instructions with 1 register write operand: 791,740,368
- Number of instructions with 2 register write operands: 58,409,915
- Number of instructions with 3 register write operands: 126
- Number of instructions with 4 register write operands: 30

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 273,540,881
- Number of instructions with 1 memory operand: 690,600,449
- Number of instructions with 2 memory operands: 35,858,671

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 150924611
- Number of Instructions with 1 memory read operand: 575534479
- Number of Instructions with 2 memory read operand: 30

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 539675868
- Number of Instructions with 1 memory write operand: 186783252

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 7.35779

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 1,431,655,766
- Minimum value of the immediate field: -2,147,483,648

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 135,701,372
- Minimum value of the displacement field: -2,620

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- Time elapsed: 328.566 minutes

Analysis of 450.soplex ref.mps

PART A

- Number of loads: 547,814,288 (33.27%)
- Number of stores: 98,790,336 (6.00%)
- Number of nops: 3,550 (0.00%)
- Number of direct calls: 3,177,232 (0.19%)
- Number of indirect calls: 111 (0.00%)
- Number of returns: 3,177,343 (0.19%)
- Number of unconditional branches: 12,757,529 (0.77%)
- Number of conditional branches: 103,253,208 (6.27%)
- Number of logical operations: 13,995,942 (0.85%)
- Number of rotate/shift operations: 10,482,916 (0.64%)
- Number of flag operations: 22,971,018 (1.40%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 309,500,005 (18.80%)
- Number of other instructions: 520,681,147 (31.62%)

PART B

- CPI: 28.0956

PART C

- Number of 32-byte regions for data: 5658602
- Number of 32-byte regions for instructions: 645

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 77,588,347
- Number of instructions of 2 bytes: 441,952,204
- Number of instructions of 3 bytes: 399,694,180
- Number of instructions of 4 bytes: 16,087,417
- Number of instructions of 5 bytes: 3,219,650
- Number of instructions of 6 bytes: 40,002,895
- Number of instructions of 7 bytes: 17,518,396
- Number of instructions of 8 bytes: 3,936,912

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 3,550
- Number of instructions with 1 operand: 13
- Number of instructions with 2 operands: 412,395,185
- Number of instructions with 3 operands: 396,043,471
- Number of instructions with 4 operands: 188,349,395
- Number of instructions with 5 operands: 3,208,387

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 23,145,723
- Number of instructions with 1 register read operand: 216,228,473
- Number of instructions with 2 register read operands: 578,645,197
- Number of instructions with 3 register read operands: 138,000,592
- Number of instructions with 4 register read operands: 43,948,879
- Number of instructions with 5 register read operands: 31,137

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 68,174,976
- Number of instructions with 1 register write operand: 765,096,584
- Number of instructions with 2 register write operands: 166,728,441

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 531,477,774
- Number of instructions with 1 memory operand: 439,269,167
- Number of instructions with 2 memory operands: 29,253,060

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 51701475
- Number of Instructions with 1 memory read operand: 416820752

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 387567692
- Number of Instructions with 1 memory write operand: 80954535

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 5.27062

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 2,147,483,647
- Minimum value of the immediate field: -640,172,613

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 135,855,532
- Minimum value of the displacement field: -344

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- Time elapsed: 135.5 minutes

Analysis of 456.hmmer nph3.hmm

PART A

- Number of loads: 547,670,868 (33.74%)
- Number of stores: 75,699,003 (4.66%)
- Number of nops: 34,317 (0.00%)
- Number of direct calls: 144,578 (0.00%)
- Number of indirect calls: 937 (0.00%)
- Number of returns: 145,515 (0.00%)
- Number of unconditional branches: 205,820 (0.01%)
- Number of conditional branches: 144,361,246 (8.89%)
- Number of logical operations: 1,158,481 (0.07%)
- Number of rotate/shift operations: 294,092 (0.02%)
- Number of flag operations: 5,648 (0.00%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)

- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 40,212 (0.00%)
- Number of other instructions: 853,608,192 (52.58%)

PART B

- CPI: 27.4958

PART C

- Number of 32-byte regions for data: 85332
- Number of 32-byte regions for instructions: 459

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 25,077,942
- Number of instructions of 2 bytes: 302,860,329
- Number of instructions of 3 bytes: 296,150,834
- Number of instructions of 4 bytes: 270,389,404
- Number of instructions of 5 bytes: 24,861,187
- Number of instructions of 6 bytes: 68,360,459
- Number of instructions of 7 bytes: 416,472
- Number of instructions of 8 bytes: 11,883,374

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 34,887
- Number of instructions with 1 operand: 3,491
- Number of instructions with 2 operands: 566,127,612
- Number of instructions with 3 operands: 432,938,052
- Number of instructions with 4 operands: 712,697
- Number of instructions with 5 operands: 159,485
- Number of instructions with 6 operands: 23,777

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 610,916
- Number of instructions with 1 register read operand: 75,619,818
- Number of instructions with 2 register read operands: 562,398,554
- Number of instructions with 3 register read operands: 281,426,011
- Number of instructions with 4 register read operands: 79,906,018
- Number of instructions with 5 register read operands: 14,907
- Number of instructions with 6 register read operands: 23,777

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 75,149,741
- Number of instructions with 1 register write operand: 755,279,814
- Number of instructions with 2 register write operands: 169,546,669
- Number of instructions with 3 register write operands: 23,777

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 376,807,698
- Number of instructions with 1 memory operand: 623,025,328
- Number of instructions with 2 memory operands: 166,012

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 75528355
- Number of Instructions with 1 memory read operand: 547662985

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 547496973
- Number of Instructions with 1 memory write operand: 75694367

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 3.99751

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 2,147,483,647
- Minimum value of the immediate field: -987,654,321

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 135,294,312
- Minimum value of the displacement field: -580

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- Time elapsed: 118.33 minutes

Analysis of 462.libquantum (Optional)

PART A

- Number of loads: 279,866,839 (19.86%)
- Number of stores: 129,203,316 (9.17%)
- Number of nops: 0 (0.00%)
- Number of direct calls: 556,660 (0.04%)

- Number of indirect calls: 0 (0.00%)
- Number of returns: 556,662 (0.04%)
- Number of unconditional branches: 834,552 (0.06%)
- Number of conditional branches: 157,417,407 (11.17%)
- Number of logical operations: 146,293,187 (10.38%)
- Number of rotate/shift operations: 107,083,370 (7.60%)
- Number of flag operations: 0 (0.00%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 0 (0.00%)
- Number of other instructions: 587,258,163 (41.68%)

PART B

- CPI: 21.0315

PART C

- Number of 32-byte regions for data: 1048594
- Number of 32-byte regions for instructions: 67

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 61,187,337
- Number of instructions of 2 bytes: 442,810,048
- Number of instructions of 3 bytes: 437,559,983
- Number of instructions of 4 bytes: 51,733,091
- Number of instructions of 5 bytes: 834,753
- Number of instructions of 6 bytes: 1,113,140
- Number of instructions of 7 bytes: 4,761,649

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 0
- Number of instructions with 1 operand: 0
- Number of instructions with 2 operands: 467,945,153
- Number of instructions with 3 operands: 476,703,758
- Number of instructions with 4 operands: 54,794,430
- Number of instructions with 5 operands: 556,660
- Number of instructions with 6 operands: 0

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 0
- Number of instructions with 1 register read operand: 314,502,902
- Number of instructions with 2 register read operands: 461,095,364
- Number of instructions with 3 register read operands: 223,845,205
- Number of instructions with 4 register read operands: 556,530
- Number of instructions with 5 register read operands: 0
- Number of instructions with 6 register read operands: 0

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 101,552,914
- Number of instructions with 1 register write operand: 655,482,293
- Number of instructions with 2 register write operands: 242,408,518
- Number of instructions with 3 register write operands: 556,276
- Number of instructions with 4 register write operands: 0

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 616,075,378
- Number of instructions with 1 memory operand: 358,779,091
- Number of instructions with 2 memory operands: 25,145,532

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 104057784
- Number of Instructions with 1 memory read operand: 279866839

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 254721307
- Number of Instructions with 1 memory write operand: 129203316

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 4
- Average number of memory bytes touched: 3.60445

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 124
- Minimum value of the immediate field: -1

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 134,982,404
- Minimum value of the displacement field: -64

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- Time elapsed: 1151.5 minutes

Analysis of 470.lbm (Optional)

PART A

- Number of loads: 709,934,673 (35.99%)
- Number of stores: 262,839,437 (13.32%)
- Number of nops: 14 (0.00%)
- Number of direct calls: 163 (0.00%)
- Number of indirect calls: 16 (0.00%)
- Number of returns: 179 (0.00%)
- Number of unconditional branches: 4,766,488 (0.24%)
- Number of conditional branches: 7,787,501 (0.39%)
- Number of logical operations: 5,058,559 (0.26%)
- Number of rotate/shift operations: 196 (0.00%)
- Number of flag operations: 76,577 (0.00%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 965,351,293 (48.93%)
- Number of other instructions: 16,959,015 (0.86%)

PART B

- CPI: 35.0239

PART C

- Number of 32-byte regions for data: 13121299
- Number of 32-byte regions for instructions: 380

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 103,155
- Number of instructions of 2 bytes: 487,558,164
- Number of instructions of 3 bytes: 179,608,558
- Number of instructions of 4 bytes: 891
- Number of instructions of 5 bytes: 7,578,433
- Number of instructions of 6 bytes: 324,480,870

- Number of instructions of 7 bytes: 645,484
- Number of instructions of 8 bytes: 0
- Number of instructions of 9 bytes: 0
- Number of instructions of 10 bytes: 24446

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 14
- Number of instructions with 1 operand: 19
- Number of instructions with 2 operands: 13,356,458
- Number of instructions with 3 operands: 457,056,028
- Number of instructions with 4 operands: 529,587,275
- Number of instructions with 5 operands: 179
- Number of instructions with 6 operands: 28

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 44,826,365
- Number of instructions with 1 register read operand: 133,976,206
- Number of instructions with 2 register read operands: 604,383,853
- Number of instructions with 3 register read operands: 216,813,394
- Number of instructions with 4 register read operands: 139
- Number of instructions with 5 register read operands: 16
- Number of instructions with 6 register read operands: 28

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 131,899,209
- Number of instructions with 1 register write operand: 822,012,002
- Number of instructions with 2 register write operands: 46,088,635
- Number of instructions with 3 register write operands: 155

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 510,671,858
- Number of instructions with 1 memory operand: 489,303,504
- Number of instructions with 2 memory operands: 24,639

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 131823384
- Number of Instructions with 1 memory read operand: 357504759

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 357480120
- Number of Instructions with 1 memory write operand: 131848023

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 7.95171

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 2,147,483,647
- Minimum value of the immediate field: -1,672,357,186

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 3,216,104
- Minimum value of the displacement field: -16,080

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- Time elapsed: 314.83 minutes

Analysis of 471.omnetpp

PART A

- Number of loads: 371,234,918 (23.19%)
- Number of stores: 229,793,821 (14.35%)
- Number of nops: 802,441 (0.05%)
- Number of direct calls: 21,327,956 (1.33%)
- Number of indirect calls: 3,689,215 (0.23%)
- Number of returns: 25,017,168 (1.56%)
- Number of unconditional branches: 22,189,452 (1.39%)
- Number of conditional branches: 117,334,362 (7.33%)
- Number of logical operations: 60,009,502 (3.75%)
- Number of rotate/shift operations: 7,139,641 (0.45%)
- Number of flag operations: 20,159,544 (1.26%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 96,963,335 (6.06%)
- Number of other instructions: 625,367,385 (39.06%)

PART B

- CPI: 26.9027

PART C

- Number of 32-byte regions for data: 528237
- Number of 32-byte regions for instructions: 890

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 154,578,970
- Number of instructions of 2 bytes: 308,549,823
- Number of instructions of 3 bytes: 382,075,614
- Number of instructions of 4 bytes: 34,347,989
- Number of instructions of 5 bytes: 45,117,306
- Number of instructions of 6 bytes: 48,822,940
- Number of instructions of 7 bytes: 26,506,938
- Number of instructions of 8 bytes: 0
- Number of instructions of 9 bytes: 0
- Number of instructions of 10 bytes: 421

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 802,441
- Number of instructions with 1 operand: 225,859
- Number of instructions with 2 operands: 518,294,498
- Number of instructions with 3 operands: 281,742,813
- Number of instructions with 4 operands: 172,764,813
- Number of instructions with 5 operands: 25,030,762
- Number of instructions with 6 operands: 1,138,815

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 28,999,923
- Number of instructions with 1 register read operand: 197,518,541
- Number of instructions with 2 register read operands: 540,431,396
- Number of instructions with 3 register read operands: 219,767,252
- Number of instructions with 4 register read operands: 8,457,506
- Number of instructions with 5 register read operands: 3,686,568
- Number of instructions with 6 register read operands: 1,138,815

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 165,351,614
- Number of instructions with 1 register write operand: 665,540,109
- Number of instructions with 2 register write operands: 167,593,457
- Number of instructions with 3 register write operands: 376,006
- Number of instructions with 4 register write operands: 1,138,815

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 449,247,908
- Number of instructions with 1 memory operand: 542,987,076
- Number of instructions with 2 memory operands: 7,765,017

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 212453143
- Number of Instructions with 1 memory read operand: 337160135
- Number of Instructions with 2 memory read operand: 1138815

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 331672748
- Number of Instructions with 1 memory write operand: 219079345

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 4.22175

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 2,147,483,647
- Minimum value of the immediate field: -2,092,037,281

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 136,090,116
- Minimum value of the displacement field: -104

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- Time elapsed: 31.86 minutes

Analysis of 483.xalancbmk

PART A

- Number of loads: 357,438,130 (23.63%)
- Number of stores: 155,776,728 (10.30%)
- Number of nops: 26,112,339 (1.73%)
- Number of direct calls: 11,530,408 (0.76%)
- Number of indirect calls: 8,838,361 (0.58%)
- Number of returns: 20,372,818 (1.35%)
- Number of unconditional branches: 7,564,623 (0.50%)
- Number of conditional branches: 191,229,242 (12.64%)
- Number of logical operations: 34,154,887 (2.26%)
- Number of rotate/shift operations: 4,926,497 (0.33%)
- Number of flag operations: 1,448,128 (0.10%)
- Number of vector operations: 0 (0.00%)
- Number of conditional moves: 0 (0.00%)
- Number of MMX/SSE operations: 0 (0.00%)
- Number of system calls: 0 (0.00%)
- Number of FP operations: 6,322,849 (0.42%)
- Number of other instructions: 687,088,165 (45.42%)

PART B

- CPI: 24.4081

PART C

- Number of 32-byte regions for data: 885608
- Number of 32-byte regions for instructions: 2269

PART D

D1: Distribution of Instruction Length (All Instructions)

- Number of instructions of 1 byte: 143,612,824
- Number of instructions of 2 bytes: 332,671,505
- Number of instructions of 3 bytes: 445,803,240
- Number of instructions of 4 bytes: 28,414,379
- Number of instructions of 5 bytes: 21,378,488
- Number of instructions of 6 bytes: 21,063,285
- Number of instructions of 7 bytes: 6,719,012
- Number of instructions of 8 bytes: 229,735
- Number of instructions of 9 bytes: 51,390
- Number of instructions of 10 bytes: 56,143

D2: Distribution of Number of Operands (All Instructions)

- Number of instructions with 0 operands: 26,112,339
- Number of instructions with 1 operand: 648,422
- Number of instructions with 2 operands: 409,723,232
- Number of instructions with 3 operands: 432,923,940
- Number of instructions with 4 operands: 91,910,568
- Number of instructions with 5 operands: 22,067,688
- Number of instructions with 6 operands: 16,613,812

D3: Distribution of Number of Register Read Operands (All Instructions)

- Number of instructions with 0 register read operands: 32,925,768
- Number of instructions with 1 register read operand: 245,144,477
- Number of instructions with 2 register read operands: 446,314,462
- Number of instructions with 3 register read operands: 249,204,184
- Number of instructions with 4 register read operands: 1,061,541
- Number of instructions with 5 register read operands: 8,735,757
- Number of instructions with 6 register read operands: 16,613,812

D4: Distribution of Number of Register Write Operands (All Instructions)

- Number of instructions with 0 register write operands: 109,059,672
- Number of instructions with 1 register write operand: 695,139,176
- Number of instructions with 2 register write operands: 179,185,386
- Number of instructions with 3 register write operands: 16,615,767

D5: Distribution of Number of Memory Operands (Predicated Instructions)

- Number of instructions with 0 memory operands: 517,108,059
- Number of instructions with 1 memory operand: 454,756,765
- Number of instructions with 2 memory operands: 27,723,493

D6 Distribution of Memory Read Operands

- Number of Instructions with 0 memory read operands: 127065900
- Number of Instructions with 1 memory read operand: 355414358

D7 Distribution of Memory Write Operands

- Number of Instructions with 0 memory write operands: 327690865
- Number of Instructions with 1 memory write operand: 154789393

D8: Maximum and Average Number of Memory Bytes Touched (Predicated Instructions)

- Maximum number of memory bytes touched: 8
- Average number of memory bytes touched: 4.17911

D9: Maximum and Minimum Values of Immediate Field in an Instruction

- Maximum value of the immediate field: 2,147,483,647
- Minimum value of the immediate field: -1,431,655,765

D10: Maximum and Minimum Values of Displacement Field in a Memory Instruction (Predicated Instructions)

- Maximum value of the displacement field: 139,655,605
- Minimum value of the displacement field: -1,392

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- Time elapsed: 536.4 minutes